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ABSTRACT

Factors that influence the length of time between receipt of the doctorate and award of tenure for college faculty were investigated. Data were collected from 293 responses to questionnaires returned by doctoral recipients from Stanford University, Yale University, and the Massachusetts Institute of Technology. Respondents had received doctorates in 1963-1965 or 1970-1972 in anthropology, biology, economics, English, history, philosophy, political science, psychology, or sociology. The length of time to achieve tenure was analyzed from several perspectives: (1) observed time to tenure for respondents who received tenure; (2) estimated time to tenure including "censored" data from those still working toward tenure and those who left the tenure track, using survival analysis; (3) testing the significance of variables related to time to tenure, using the Cox proportional hazards regression model, and (4) investigating individual cases of respondents who had unusually long periods between receiving the Ph.D. and being awarded tenure and of those who were still working toward tenure. The career and family patterns of faculty who were still seeking tenure were assessed. More than 90% of respondents originally began academic careers; by 1983 78% of these men and 62% of these women had been awarded tenure. (SW)

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Time to Tenure: The Intersection of Academic Careers and Family Patterns

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This paper reports a portion of larger research project investigating the relationship between academic careers and family patterns.[1] One of the questions asked about academic career patterns is: how long does it take an individual to achieve tenure? And what variables seem to influence the length of time between receipt of the doctorate and award of tenure? This paper considers these and related questions in a variety of ways.

Time to tenure, that is, the length of time between receiving the doctorate and being awarded tenure, is investigated for a sample of those who received doctorates in the early 1960s and early 1970s. Observed time to tenure is reported; then, a more sophisticated approach, survival data anlysis, takes into consideration those who were still working on tenure at the time the data was collected and those who left the "tenure track" without tenure. In addition, time to leaving the tenure track is investigated. Gender and cohort differences are examined. Cox regression analyses are used to test for significance of certain covariates in modelling time to tenure. Finally, the career and family patterns of those who were still working on tenure at the close of the study are considered.

Brief Review of Literature

A pervasive omission of the general literature on the academic labor market has been any speculation or analysis of how an individual's career pattern might be influenced by family roles.[2] In contrast, the literature on academic women has often focused directly on the combination of roles of professor, mother, and wife. Thus, in investigating extra-professional influences upon academic career patterns, it is necessary to draw heavily upon the literature which deals with academic women. Literature dealing with academic men's family concerns is nearly non-existent.[3]

Little is known about the interaction between family patterns and academic careers. For

instance, in the academic profession, as in some others, there is no readily apparent optimal time for childbearing; the prime years of childbearing usually occur just when the pressures to establish one's career are greatest.

As long ago as 1958, in their classic study of the academic marketplace, Caplow and McGee noted that women could not look forward to normal academic careers. They wrote:

> women tend to be discriminated against in the academic profession, not because they have low prestige but because they are outside the prestige system entirely and for this reason are of no use to a department in future recruitment.

Hochschild (1975) has suggested that "the classic profile of the academic career is cut to the image of the traditional man with his traditional wife." Our understanding of academic career patterns may be flawed if it is always based upon a traditional male model. One interpretation is that the existing academic career subcontracts work to the family -- work women perform -- and that without changing the structure of this career and its relation to the family, it will be impossible for married women to move up in careers and for men to move into the family (Hochschild, 1975). Yet an increasing proportion of women doctorates are married (Centra, 1974; Astin, 1981), and it may be that this increase implies that a change in the structure of the academic career is under way.

It is clear that scholarship and marriage are not combined as easily for women as they are for men. Centra (1974) found 39% of women doctoral recipients of 1950, 1951, and 1960, and 30% of those graduated in 1968, had not married by 1972, as compared with less than 10% of their male counterparts for those years. For that same sample, one in four marriages of women doctorates ended in divorce, compared to one in ten for men, despite the fact that the women were 4-5 years older than their male counterparts on average.

Bernard (1964) quotes Margaret Mead as saying, "the academic world is fundamentally

hostile, by tradition... to those aspects of femininity which involve child bearing." For those women who do decide to combine children and academic careers, as men have done in the past, more often than not the timing of childbirth is critical. It is thought to be nearly impossible to absent oneself from the professional academic labor market for a time and then re-enter at a tenure-track or tenured level (Caplow and McGee, 1958). Thus, Strober and Quester (1977) reported that of 212 women Ph.D.s employed full-time as academic economists, only 9% had ever had a gap in employment of six months or more since receiving the doctorate, and Astin's (1969) study of women who received the Ph.D. in 1957 and 1958 found that after ten years, less than one-fifth of the 91% who were employed had interrupted their careers, and those interruptions averaged only 14 months.

Astin and Bayer (1979) found that married women in academe get off to a slow start in the early years of their careers, but they become more productive over the years, catching up to their single counterparts. They suggest this lag is probably due to their having greater family responsibilities at this time. A study of career outcomes of a matched sample of men and women doctorates found unmarried women or those without children did not fare any better in faculty promotions than married women with children (National Research Council, 1981). Hamovitch and Morgenstern (1977) used a subsample of the Carnegie - American Council on Education survey of college and university faculty in the late 1960s[4] to study the influence of childrearing on the academic productivity of full-time faculty. Women faculty were found to publish somewhat less than men, and no evidence was found to support the hypothesis that childrearing is directly related to the number of publications of academic women or men. Hamovitch and Morgenstern note, however, that:

> The... analysis has been based on cross-sectional data and thus has not been able to deal with issues such as the possible effect of the timing of children on the productivity of academic women. To address this type of

> issue requires a comprehensive set of longitudinal data, to enable the researcher to obtain a 'moving picture' as opposed to a 'snapshot' of the work processes of academia. Unfortunately, such a sample was not available to us.

Their study focused on those currently holding full-time faculty positions, and thus could not consider those who may have cut back to part-time or dropped out of the academic labor market altogether as a result of the demands of childrearing. A study of career outcomes in a matched sample of men and women doctorates found only 10% of the women with young children dropped out of the labor force (National Research Council, 1981).

In some respects, faculty are thought to suffer less from the pressures of childrearing than working parents with more rigidly-defined schedules of work (Kamerman, 1980). Yet Fowlkes (1980) points out:

> On the other hand, the much-touted flexibility of academic work can be overemphasized. In reality... it is a flexibility that pertains more to the possibility of making minor alterations in daily routines than to any shifts in the overall structure and chronology in the academic career, which requires scholarly production at a certain level on an implicit time schedule to assure academic advancement.

She also notes that the "inner-directedness" of academic work yields not only flexibility but a particular kind of anxiety, the pervasive feeling that work is either never done or, once done, is never adequate.

From this introduction to some of the factors which may influence the course of academic careers, we turn to the question of the length of time between receiving the doctorate and the award of tenure, and variables affecting that time to tenure.

Data Source

The data was collected from 293 responses to questionnaires returned by doctoral recipients from Stanford University, Yale University, and the Massachusetts Institute of Technology. Respondents had received doctorates in the years 1963-65 (Cohort I) or 1970-72

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Cohort II), in anthropology, biology, economics, English, history, philosophy, political science, psychology, or sociology; the numbers of men and women in the sample were approximately equal within each disciplinary field and time cohort. To gather detailed data about individuals' career and family histories, they were encouraged to supply current *curriculum vitae*. Approximately 45% of the original sample of 659 returned the questionnaire. Those who received degrees from Stanford and women were slightly more likely to have responded, while those who received doctorates in history were slightly less likely to have responded.

The respondents included in this set of analyses are those who began academic positions after receiving their Ph.D.s, those who had left tenure track positions before receiving tenure, those who were still in academic positions but had not yet received tenure, and those who had received tenure by 1983 when the survey was conducted.

Description of Observed Time to Tenure

The following tables indicate the numbers and percentages of respondents who embarked on academic careers and their tenure status as of 1983, and give data by gender, by cohort, and for gender within cohort.

Table 1: Classification of respondents' post-doctorate career paths

Gender	Cohort	Total number of respondents	respondents who began academic jobs	respondents who did not begin academic jobs	respondents for whom info. was not available
Men	Cohort I	54	51 (94.4%)	3 (5.5%)	0
	Cohort II	101	91 (90.1%)	6 (5.9%)	4 (4.0%)
	All	155	142 (91.6%)	9 (5.8%)	4 (2.6%)
Women	Cohort I	37	33 (89.2%)	4 (10.8%)	0
	Cohort II	101	91 (90.1%)	7 (6.9%)	3 (3.0%)
	All	138	124 (89.9%)	11 (8.0%)	3 (2.2%)
All	Cohort I	91	84 (92.3%)	7 (7.7%)	0
	Cohort II	202	182 (90.1%)	13 (6.4%)	7 (3.5%)
Total	All	293	266 (90.8%)	20 (6.8%)	7 (2.4%)

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More than 90% of the respondents originally began careers in academe, and there was no wide variance in this statistic by gender or by cohort. Now consider what became of those who began academic careers by the time the data was collected in 1983:

Table 2: Classification of respondents who began academic careers and their tenure status in 1983

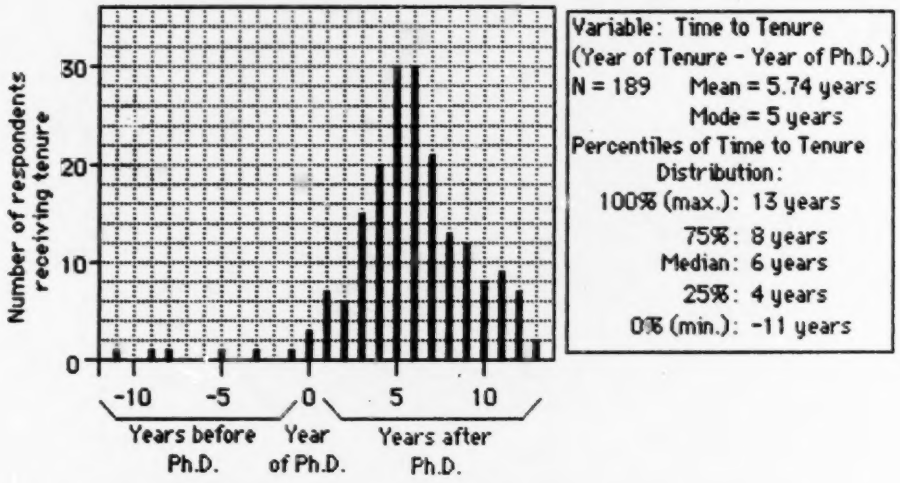
Gender	Cohort	# of respondents who began academic jobs	Status as of 1983				
			tenure track	non-tenured teach/ rsrch. appt.	left academe before receiving tenure	left teaching/ research for administration prior to tenure	tenured
Men	Cohort I	51	0	0	6 (11.8%)	0	45(88.2%)
	Cohort II	91	4 (4.4%)	2 (2.2%)	17 (18.7%)	3 (3.3%)	65(71.4)
	All	142	4 (2.8%)	2 (1.4%)	23 (16.2%)	3 (2.1%)	110(77.5)
Women	Cohort I	33	0	3 (9.1%)	6 (18.2%)	1 (3.0%)	23(70.0)
	Cohort II	91	7 (7.7%)	11(12.1)	16 (17.6%)	3 (3.3%)	54(59.3)
	All	124	7 (5.6%)	14(11.3)	22 (17.7%)	4 (3.2%)	77(62.1)
All	Cohort I	84	0	3 (3.6%)	12 (14.3%)	1 (1.2%)	68 (81.0)
	Cohort II	182	11(6.0%)	13(7.1%)	33 (18.1%)	6 (3.3%)	119(65.4)
Total	All	266	11(4.1)	16 (6.0)	45 (16.9%)	7 (2.6%)	187(70.3)

Men were more likely to be in tenured positions by 1983, whereas women were more likely still to be working toward tenure or in non-tenure-track positions in teaching or research. Men and women left academic positions before receiving tenure in roughly the same proportions. Not surprisingly, since most of them are farther along in their careers, those in Cohort I were more likely to be in tenured positions and less likely still to be working toward tenure. Men in Cohort II were more likely than men in Cohort I to have left the academic profession before receiving tenure, which may be a reflection of the tighter labor market conditions facing that cohort and a greater likelihood of being denied tenure. Women from both cohorts left academic positions in roughly the same proportions as men in Cohort II.

Figure 1 shows a summary of observed time to tenure for those respondents who had received tenure by 1983. To compute time to tenure in this fashion, the calendar year in which

the doctorate was received was subtracted from the calendar year in which the Ph.D. was granted for each respondent. For those who had never been granted tenure, the time to tenure was a missing variable.

Figure 1:
Time to Tenure
(for respondents already awarded tenure by 1983)



An interesting phenomenon was observed once the data were calculated: for nine respondents who had been granted tenure, the time-to-tenure was negative or zero. Several explanations might account for this phenomenon. The first possibility examined was that of a coding error. Upon double-checking, however, no coding errors were found. A second possibility was that the respondent had erred in indicating the correct year of tenure. In one case, this possibility seemed distinctly likely though it was not verifiable. In the other cases, a third possibility seemed most likely: several decades ago, it was not uncommon for college and university faculty not to have the Ph.D. and thus, some faculty were granted tenure without ever having earned a doctorate. As the following tables indicate, individuals with negative or zero time-to-tenure were older when they received their doctorates than nearly three-quarters of the respondents, and those with negative time-to-tenure fell within the eight percent of the sample that was oldest at time of receiving Ph.D. If age can be taken to be an indicator of the

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start of one's career, then there is support for the hypothesis that receipt of tenure before or concurrently with receipt of the doctorate is less likely to occur in recent years.

Table 3: Characteristics of respondents with negative or zero time-to-tenure

Time-to-tenure (in years)	Year of Ph.D.	Gender	Field of study	Age at Ph.D.
-11	1972	Female	English	47
-9	1964	Male	Economics	49
-8	1970	Male	Biology	36
-5	1971	Male	Biology	43
-3	1964	Male	Philosophy	37
-1	1972	Female	English	42
0	1971	Male	History	31
0	1972	Male	Philosophy	30
0	1972	Male	Biology	40

Table 4: Description of age at Ph.D. for all respondents

Variable: Age at Ph.D. (Year of Ph.D. - Year of birth)
N = 293 Mean: 29.5 years Mode: 27 years
Percentiles of the Age-at-Ph.D. Distribution:

100% (max.):	49 years
92.2%:	36 years
75%:	31 years
Median:	28 years
25%:	27 years
0% (min.):	23 years

While these particular cases are interesting because of the unexpected sequence of tenure prior to or in conjunction with receipt of the doctorate, as outliers they skew the calculations of time-to-tenure. In addition, the programs for calculating time to tenure using survival data analysis omit cases for which time to tenure is less than or equal to zero. Thus, these cases were not included in most of the following analyses of time-to-tenure. For the sake of comparison, in one analysis the values for zero or negative time to tenure were set to .01, and the results compared with analysis which omitted the cases.

Table 5 gives observed times to tenure, by cohort and by gender, omitting those cases for which time-to-tenure was less than or equal to zero.

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Table 5: Observed time to tenure, in years

Group of respondents		% of respondents who began jobs in academe and who were awarded tenure by 1983	Percentiles of time to tenure distribution			Mean time to tenure
			75th	Median	25th	
Total		70.3%	4.0	6.0	8.0	6.2
Cohort I: 1963-65	Men	88.2%	4.0	5.0	7.0	5.6
	Women	70.0%	4.0	8.0	11.0	7.6
	All	81.0%	4.0	6.0	8.0	6.6
Cohort II: 1970-72	Men	71.4%	4.0	6.0	7.0	5.8
	Women	59.3%	5.0	6.0	8.0	6.7
	All	65.4%	4.0	6.0	8.0	6.2
All Men		77.5%	4.0	5.5	7.0	5.5
All Women		62.1%	5.0	7.0	9.0	6.9

The second column of the table above shows the percentage of respondents who had been awarded tenure by 1983. The three columns showing percentiles of time to tenure distribution indicate the median and quartiles of the distribution of time-to-tenure for respondents who have received tenure. For example, the 25th percentile shows the amount of time by which 75% of the respondents were awarded tenure. For example, 70.3% of all respondents who had begun academic jobs had been awarded tenure by 1983; considering all respondents who had been awarded tenure, the median time to tenure was six years, and by the time eight years had passed after receiving the Ph.D., 75% of all those who were awarded tenure by 1983 had achieved tenured status. The right column indicates the mean time to tenure for each group.

Within both cohorts, on average, women were granted tenure later than men relative to the year they earned their doctorates. Tenure was awarded to men in Cohort II slightly later than to men in Cohort I, while women in Cohort II earned tenure more quickly than women in Cohort I.

It also seemed possible there might be accepted norms for time to tenure within given fields. Table 6 indicates the mean observed time-to-tenure for the nine different disciplinary fields represented in the sample.

Table 6: Observed time to tenure, by field

Field of study	Number tenured			Mean time to tenure (in years)		
	Total	Men	Women	Total	Men	Women
Anthropology	7	3	4	6.4	7.0	6.0
Biology	21	12	9	7.0	6.3	8.0
Economics	10	6	4	7.8	6.3	10.0
English	58	33	25	6.2	5.0	7.7
History	12	7	5	4.8	5.0	4.4
Philosophy	15	12	3	5.1	5.3	4.7
Political Science	22	13	9	5.6	5.4	5.9
Psychology	31	16	15	6.5	6.5	6.5
Sociology	2	1	1	8.0	11.0	5.0

This table does not include the cases for which time to tenure was less than or equal to zero. There do appear to be differences in time to tenure among disciplinary fields, but the small number of cases for most of the fields make the findings unreliable.

In considering rough categories, the mean observed time-to-tenure for those with degrees in history, philosophy, and political science was less than six years, while the mean observed time-to-tenure for those in the other six areas -- anthropology, biology, economics, English, psychology, and sociology -- was more than six years. Perhaps more interesting is that for those with doctorates in English, where roughly a third of the tenured women are concentrated, the average observed time to tenure for women is 2.7 years longer than that for men; the differences in mean observed time to tenure between men and women are also pronounced in economics, biology, and sociology, but only two respondents in sociology were tenured, so the observed difference for that field is quite unreliable. For those with doctorates in anthropology, history, philosophy, political science, and sociology, gender differences for mean observed time to tenure were one year or less. We will return to discussion of these differences later in the chapter when results of the Cox regressions on time to tenure are presented.

Drawing conclusions based upon these observed times to tenure, based on calculations which subtract the year of Ph.D. from the year in which tenure was granted, is problematic,

because the cases of respondents who still might receive tenure and those who have left the academic profession without achieving tenure are ignored. For example, if we wished to inform a newly-minted Ph.D. what his or her chances were of receiving tenure by time X, based upon the data of doctoral recipients from the early 1960s and early 1970s, this analysis would be too optimistic; it underestimates the time to tenure.

Survival Analysis Methods

The difficulty in predicting time to tenure is that within any group there will be individuals who have not yet achieved tenure. It is not always clear if these individuals will be tenured at a later date or not at all. Because the data are "censored", that is, only a portion of some individuals' career patterns *en route* to tenure is available, a technique called Survival Analysis is used to refine the analysis of time to tenure (Miller, 1981).

Survival analysis was developed to deal with studies of longevity in which not all the subjects had "died". It is used to predict the likelihood of "survival", to compare survival patterns of different groups within a system, and to identify factors related to survival. The data required include survival time and subjects' characteristics which may be related to survival. In the analysis of time to tenure, tenure represents "death" in the system. Thus, the survival time represents the time to tenure. The distribution of survival times of a group of individuals can be characterized by the survival, density, and hazard functions. If one function is known, the other two may be derived. Each is used to describe a different aspect of the data. Although the underlying theories of survival analysis are based on complete information about survival times, the survival, density, and/or hazard functions may be estimated from the data, and then inferences made about the population's survival pattern, or, in this case, time to tenure.

The descriptions below follow O'Brien's (1983) interpretations. "T" represents survival

time and the distribution of T is described by the survival and hazard functions.

The survival function, S(t) is defined as the probability that an individual survives longer than time t. It is estimated as the proportion of individuals surviving longer than time t:

$$\hat{S}(t) = \frac{\text{Number of individuals surviving longer than time } t}{\text{Total number of individuals}}$$

This estimate is known as the Kaplan-Meier, or "product-limit" estimate of the survival curve. The survival function is a nonincreasing function of time t with the following properties:

1) $S(t) = 1$ when $t=0$ since the probability of survival at time 0 is one.

2) $S(t) \to 0$ as $t \to \infty$ since the probability of surviving an infinite time is zero.

The survival curve is a graph of the survival function. A gradual curve indicates a high survival rate, while a steep curve represents a low survival rate. Either the survival curve or the survival function can be used to find the median survival time or to compare the survival patterns of different groups. In the time to tenure analysis, we would expect a low "survival" rate and a steep curve if individuals are granted tenure fairly rapidly after they receive Ph.D.s.

The hazard function h(t) represents the probability of tenure during a short time interval, assuming that the individual has survived to the beginning of the interval. Thus, once again, respondents who never began an academic job after receiving their doctorates were excluded from this analysis, as were those whose observed time to tenure was less than or equal to zero. It is estimated as the proportion of individuals receiving tenure in an interval per unit time, given that they have survived to the beginning of the interval:

$$\hat{h}(t) = \frac{\text{Number of individuals receiving tenure in the interval beginning at time } t}{(\text{Number of individuals surviving at time } t)\,(\text{interval width})}$$

The hazard function represents the probability of tenure each year as an individual's time in the system increases. The expected proportion of individuals who will be granted tenure in the

year, (t, t+Δt), is (Δt)(h(t)).

Estimated Time to Tenure Using Survival Data Analysis

The survival curve for time to tenure might vary by discipline, by gender, by cohort, or by other variables. There are not enough cases in the sample to test for variability by disciplinary field; thus, the analyses here will consider other variables, namely gender and cohort.

To estimate survival curves, a subprogram of the BMDP statistical package, called BMDP 1L - Life Tables and Survival Functions, was used.[5] Thus, the BMDP 1L was used to obtain the Kaplan-Meier estimates of the cumulative probability of "surviving", that is, not having yet been granted tenure. In the time-to-tenure survival analysis, no distinction was made between those still working toward tenure and those who left academe before being awarded tenure; both were considered censored events.

It was necessary to code some new variables for the survival analyses. Twenty respondents who had never worked in academic positions after receiving the doctorate were omitted from the analyses. Another respondent who had been employed for many years by a university which does not offer tenure was also omitted. For the remaining respondents (n=272), it was first necessary to determine whether they had received tenure, were still working toward tenure, or had left the academic profession.[6] This variable was coded as SURVIVAL, for which 0=tenured, 1=still working toward tenure, and 2=left. Next, the variable EXITTT (time of exit from the tenure track) was coded. For those who had tenure by 1983, it was necessary to know how many years after receiving the Ph.D. they were awarded tenure. For those still working toward tenure, the number of years post-Ph.D. was indicated as the number of years between receiving the doctorate and the year the data was collected, 1983. For those who had left the academic profession, EXITTT was coded as the number of years between the year

of Ph.D. receipt and the year they left. Based on these data, the probability of survival for each year is calculated. These probabilities form the survival curve.

When the survival curve is estimated in this manner, its percentiles can also be estimated. These can then be compared directly to percentiles of the distribution of observed times to tenure for those who received tenure. Because the estimates using survival analysis consider those still working toward tenure, the estimated percentiles should be greater than percentiles of the distribution of observed time to tenure.

There are variations within the career patterns which lead to tenure. A very direct path to tenure is exemplified by the individual who begins an assistant professorship immediately upon receiving the Ph.D., and some time later is promoted to associate professor, generally with an accompanying award of tenure; often a promotion to full professor eventually follows. After examining the career patterns of the doctoral recipient respondents in the sample, it became clear that, although it is unusual, some individuals do achieve tenure without necessarily following this set pattern. In particular, some individuals who begin postdoctoral work in non-tenure-track positions, such as lecturing positions, instructorships, or research associate positions, eventually land the assistant professorships which put them on the tenure track. Tenure-track appointments, those in which an individual is scheduled to be reviewed for tenure after a certain length of time, may come after several years and a series of what had been considered "non-tenure-track positions." As a result, one analysis of time between receipt of the Ph.D. and award of tenure compares estimated time to tenure under two different assumptions: 1) that only those who identified themselves as being in "tenure track" positions in 1983 were still possibly being considered for tenure, and 2) that those who are currently in non-tenure-track teaching or research positions as well as those in "tenure-track" positions should be included in the category of those still in academic positions who had not yet received

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tenure. Excluded in either case are those who have taken administrative positions within academe without having received tenure, because such individuals seem to have really taken a new and different direction in their careers and do not plan to return to tenure-track positions. Also excluded are those who never began work in academe upon receipt of their doctorates.

Table 7 compares the estimated time to tenure for the entire group of respondents using survival data analysis for these two different assumptions. As the table indicates, inclusion of those in non-tenure-track teaching or research positions increases the percentile estimates of time to tenure.

Table 7: Comparison of percentiles of estimated time to tenure for two different assumptions about who is still working toward tenure

	Percentiles of estimated time to tenure		
	75th	Median	25th
Including only those in tenure-track positions in 1983	4.4	6.3	9.6
Including those in tenure-track, or in non-tenure-track teaching or research positions in 1983	4.6	6.6	10.6

As noted, examination of academic career patterns indicates that some individuals in non-tenure-track teaching or research positions eventually move into tenure-track or tenured positions. Yet, in considering the cases of those respondents who were in non-tenure-track teaching or research positions in 1983, it appeared that few if any of them were still likely to move into a tenure-track or tenured position. Thus, the rest of the analyses are based upon the assumption that, for this sample, only those who indicated they were in tenure-track positions in 1983 were still working toward tenure.

As mentioned earlier, a technical difficulty arises with cases for which time to tenure was negative or zero when using survival data analysis. Although these nine cases were omitted for

the analyses of time to tenure, it is worthwhile for the sake of comparison to set time to tenure for each of them to .01, or just above zero, since the analysis is not set up to handle negative or zero survival times. Table 8 compares estimated time to tenure using survival data analysis for all respondents, setting time to tenure to .01 for those who received tenure before their doctorates, with respondents not including those who received tenure before their doctoral degrees.

Table 8: Comparison of percentiles of estimated time to tenure for all respondents and for respondents not including those with negative or zero observed time to tenure

Group	Percentiles of estimated time to tenure		
	25th	Median	75th
All respondents	4.2	6.1	9.5
Respondents not yet tenured or for whom time to tenure > 0	4.4	6.3	9.6

Including those for whom time to tenure was less than or equal to zero, but setting their times to tenure at .01, yields slightly shorter estimates of time to tenure, but there is not much difference between the percentile estimates.

Estimated Time to Tenure by Gender and Cohort

Table 9 indicates the median and quantiles of the estimated time to tenure for the whole sample, for each gender, for each cohort, and for each gender by cohort.

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Table 9: Kaplan-Meier estimates of time-to-tenure, in years

Gender	Cohort	Percentiles of the estimated survival curve		
		75th	Median	25th
Men	Cohort I	4.12	5.34	7.67
	Cohort II	4.10	5.74	8.59
	All	4.11	5.58	8.32
Women	Cohort I	5.80	9.07	11.38
	Cohort II	5.01	7.15	10.73
	All	5.07	7.64	11.01
All	Cohort I	4.27	6.17	9.81
	Cohort II	4.53	6.29	9.46
Total	All	4.43	6.26	9.63

As these results indicate, there continue to be marked differences in estimated time to tenure for men and women; differences between all respondents in Cohort I and all respondents in Cohort II are slight. By 5.58 years post-Ph.D., half of the men entering academe were awarded tenure; in contrast, it was 7.64 years post-Ph.D. before half the women entering academic careers were awarded tenure. When gender by cohort differences are considered, we can see that men in Cohort II are being granted tenure after a slightly longer time than were men in Cohort I. The reverse is true for women: women in Cohort II are being granted tenure after a shorter time than were women in Cohort I. Though women's time to tenure is usually longer than that for men, if the difference between cohorts can be taken as an indication of change over time, it would appear that the gender differences in time to tenure are beginning to converge.

In comparing this table to the earlier table of observed time-to-tenure, it is apparent that the inclusion of censored data has increased the estimates of time-to-tenure, particularly for those in the last quartile to be awarded tenure.

Table 10: Comparison of percentiles of observed time-to-tenure distribution with percentiles of estimated time to tenure using survival data analysis

Gender	Cohort	Percentiles of observed time to tenure			Percentiles of the estimated survival curve		
		75th	Median	25th	75th	Median	25th
Men	Cohort I	4.0	5.0	7.0	4.1	5.3	7.7
	Cohort II	4.0	6.0	7.0	4.1	5.7	8.6
	All	4.0	5.5	7.0	4.1	5.6	8.3
Women	Cohort I	4.0	8.0	11.0	5.8	9.1	11.4
	Cohort II	5.0	6.0	8.0	5.0	7.2	10.7
	All	5.0	7.0	9.0	5.1	7.6	11.0
All	Cohort I	4.0	6.0	8.0	4.3	6.2	9.8
	Cohort II	4.0	6.0	8.0	4.5	6.3	9.5
Total	All	4.0	6.0	8.0	4.4	6.3	9.6

The survival curves for different subpopulations of the sample offer insight into the patterns of tenure over time.

Figure 2: Survival curves of time-to-tenure, by gender

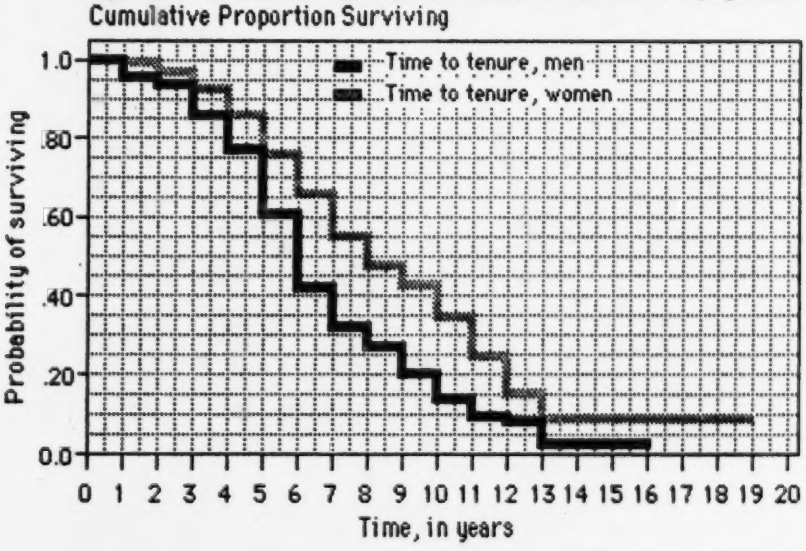

Figure 2 above shows the survival curves for time to tenure for men and women. Steep sections of the curve indicate rapid achievement of tenure, while flatter portions reflect slow rates of granting tenure. The steepest portion of the curve for men comes between 4 and 7 years after receiving the Ph.D., while the curve for women indicates a more gradual rate of tenure over a

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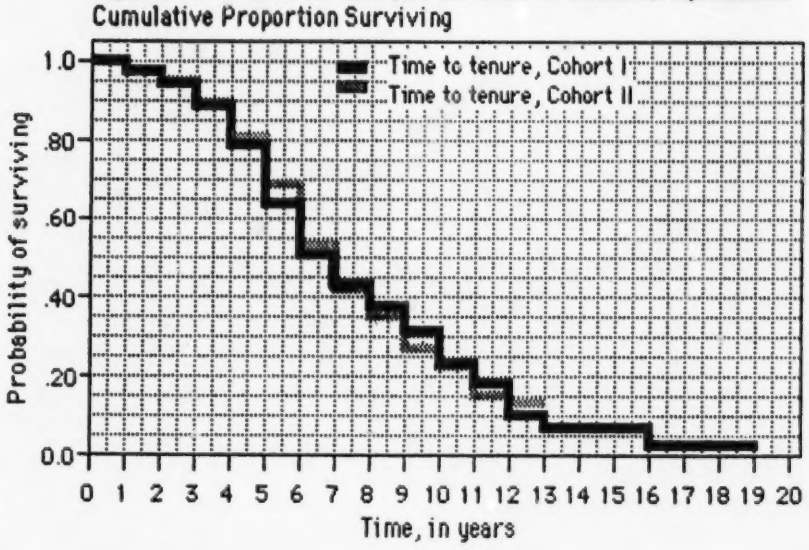
longer period of years.

Now consider the survival curves for time to tenure for the two cohorts.

Figure 3: Survival curves of time to tenure, by cohort



These two curves are very similar. The curve for Cohort II is a little less steep than that for Cohort I between years 4 and 5, but then the Cohort II curve is steeper between years 6 and 7, indicating a more rapid award of tenure for those in Cohort I between years 4 and 5, and a more rapid award of tenure for those in Cohort II between years 6 and 7.

Figure 4 shows four survival curves, one for each gender within each cohort. Though the curves for men and women in Cohort II are closer together than those in Cohort I, there are obviously still big differences in the rates of tenure. Both curves for men drop off steeply between years 4 and 7; the curve for women in Cohort I was quite gradual in comparison, while that for women in Cohort II is steeper, though still not as steep as those for the men.

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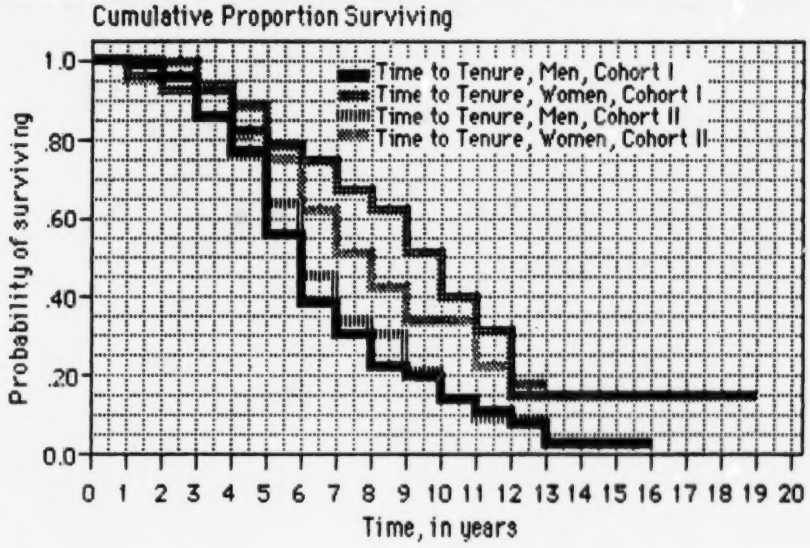
Figure 4: Survival curves for time to tenure, by cohort and gender


Cumulative Proportion Surviving
Probability of surviving
1.0
.80
.60
.40
.20
0.0
Time to Tenure, Men, Cohort I
Time to Tenure, Women, Cohort I
Time to Tenure, Men, Cohort II
Time to Tenure, Women, Cohort II
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Time, in years

Estimated Time to Leaving Tenure-Track Positions

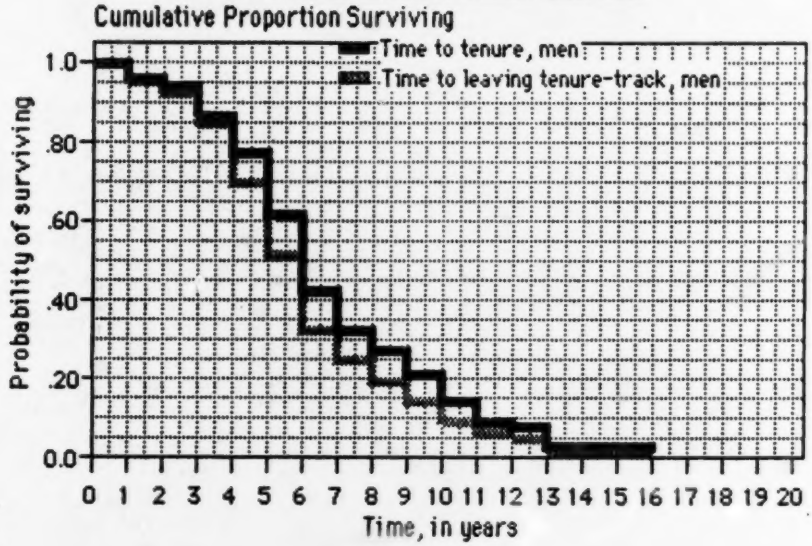
A second, slightly different survival analysis was also performed. Instead of considering time-to-tenure, this analysis estimates time to leaving the "tenure track." The distinction between the two analyses results from two types of "censored" data, reflecting two different patterns: 1) those who are still working toward tenure, and 2) those who have left tenure track positions before receiving tenure. In the second analysis, leaving a tenure-track position before receiving tenure is an event considered equivalent to receiving tenure. Thus, the estimates reflect the amount of time one might expect to stay in the tenure track, whether one leaves that track because of having received tenure, having left the academic profession altogether, or having taken an administrative or non-tenure-track position.

Table 11: Survival estimates of time to leaving tenure-track, in years

Gender	Cohort	Percentiles of the estimated survival curve		
		75th	Median	25th
Men	Cohort I	4.02	5.14	6.92
	Cohort II	3.50	5.07	6.87
	All	3.64	5.10	6.89
Women	Cohort I	4.25	8.50	11.15
	Cohort II	4.20	6.22	8.75
	All	4.18	6.55	9.60
All	Cohort I	4.17	5.77	9.75
	Cohort II	3.94	5.87	9.00
Total	All	3.84	5.54	8.34

If we compare survival curves for the two different types of analysis, time to tenure and time to leaving a tenure-track position, there is a gap represented by the vertical distance between the two curves at any time t.

Figure 5: Survival curves of time to tenure, and time to leaving tenure-track, for men



This gap is the difference between the probability of not yet having received tenure by time t and the probability of not yet having left the tenure track, tenured or not, by time t. It

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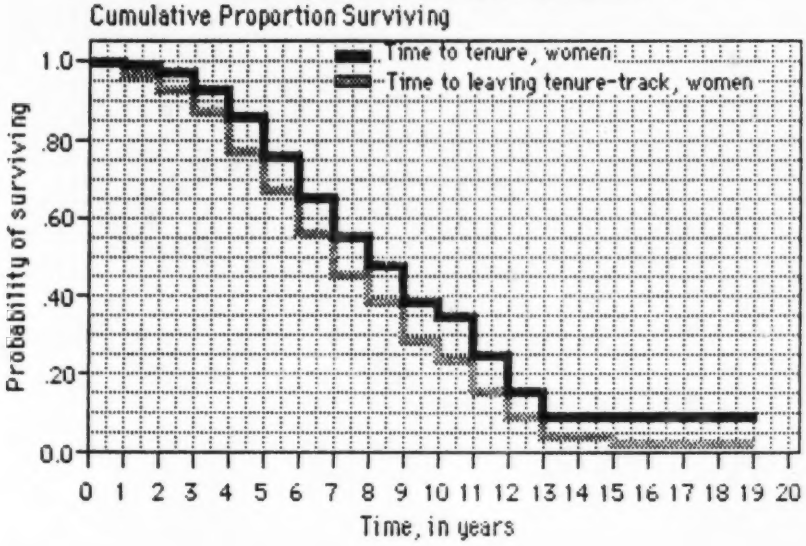
approximates the relative proportion of those leaving tenure-track positions without having received tenure. Consider the pairs of survival curves by gender and by cohort in Figures 5 and 6. For men, the gap is especially noticeable between years 5 and 7, indicating a time men were most apt to leave tenure track positions without having received tenure. It seems likely that departures from the tenure track at this time were prompted by unfavorable tenure decisions, since a standard time for tenure review is about 6 years after the doctorate is received.

Figure 6: Survival curves of time to tenure, and time to leaving tenure-track, for women



For women, the gaps were present after about year 3, but were not more pronounced at any one period than another. It may be that women in greater proportions than men leave the tenure-track for reasons other than unfavorable tenure decisions; they may become discouraged and leave early, or other factors unrelated to the tenure decision may cause them to leave. Or, perhaps women have a less standardized time for tenure review.

Figure 7: Survival curves of time to tenure and time to leaving tenure-track for Cohort I

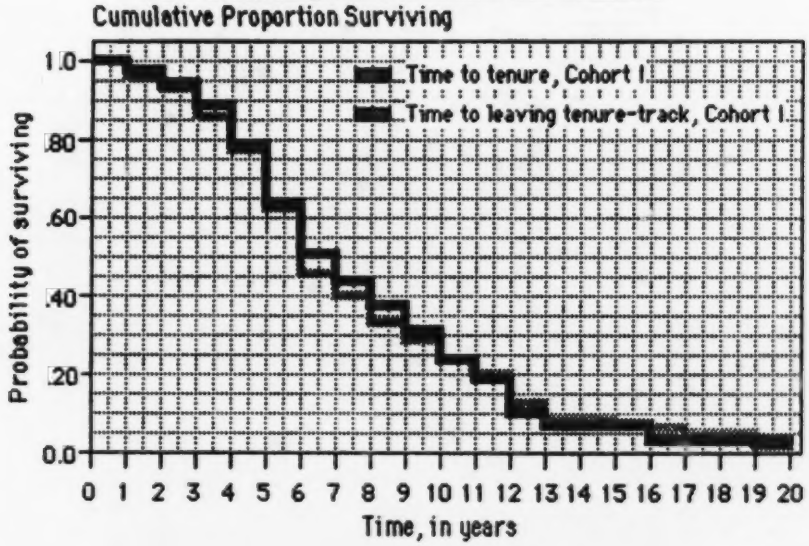
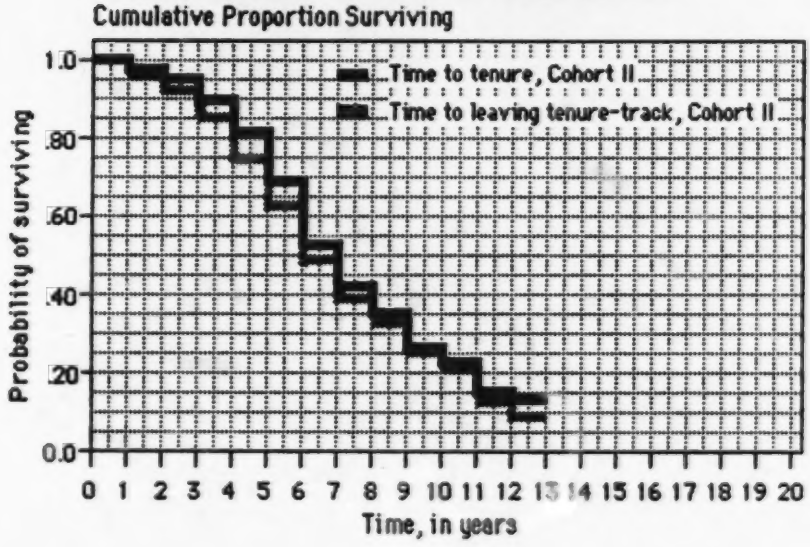


Figure 8: Survival curves of time to tenure and time to leaving tenure-track for Cohort II

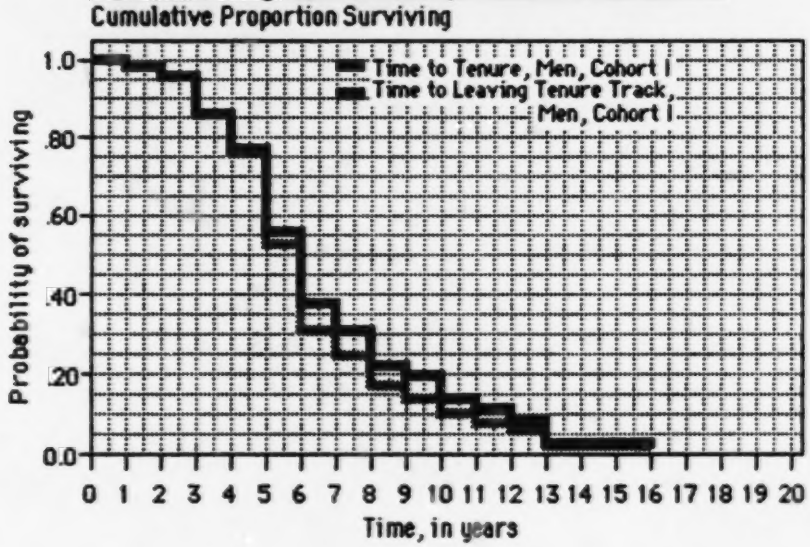


Comparison of Figures 7 and 8 is interesting. Figure 7 shows survival curves for time to tenure and time to leaving tenure-track for Cohort I. The two curves are very similar, with few gaps except at year 3 and later between years 6 and 8, indicating relatively few exits from

tenure-track positions prior to awards of tenure. In contrast, the figure for Cohort II shows gaps between the two curves beginning about year 2 and continuing for several more years. If cohort can be taken as an indicator of time, with the career events of individuals in Cohort I occuring earlier than those for Cohort II, and if the assumption that exits between years 3 and 4 and between years 6 and 7 are often reflective of unfavorable tenure reviews or decisions, then these figures suggest that fewer individuals are waiting for unfavorable tenure decisions before leaving tenure-track positions. These differences are even more pronounced when we consider the gaps between survival curves for each cohort by gender.

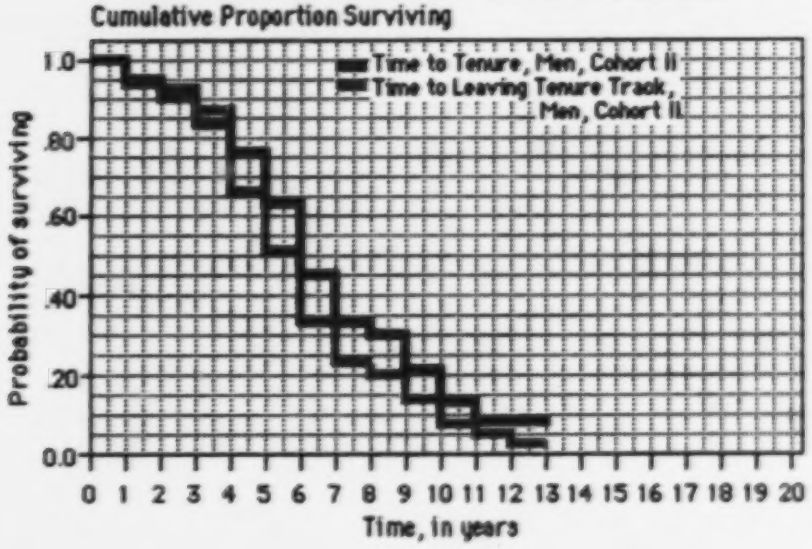
Figures 9 - 12 show the gaps approximating the relative proportion of those leaving tenure-track positions without having received tenure for each gender within each cohort.

Figure 9: Survival curves of time to tenure and time to leaving tenure-track, for men in Cohort I


Cumulative Proportion Surviving
Time to Tenure, Men, Cohort I
Time to Leaving Tenure Track, Men, Cohort I
Probability of surviving
1.0
.80
.60
.40
.20
0.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Time, in years

Until year 5, the curves are nearly identical, indicating few men in Cohort I left tenure-track positions before receiving tenure until five years or longer after receiving the Ph.D.

Figure 10: Survival curves of time to tenure and time to leaving tenure-track, for men in Cohort II


Cumulative Proportion Surviving
Time to Tenure, Men, Cohort II
Time to Leaving Tenure Track, Men, Cohort II
Probability of surviving
1.0
.80
.60
.40
.20
0.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Time, in years

In contrast to the pair of curves for men in Cohort I, this pair shows gaps beginning sooner after receiving the Ph.D. and continuing, an indication of more men leaving the tenure track before receiving tenure than previously. This trend reflects in part the diminishing chances of being awarded tenure facing the second cohort of doctoral recipients, as compared with the first.

Figure 11: Survival curves of time to tenure and time to leaving tenure-track, for women in Cohort I

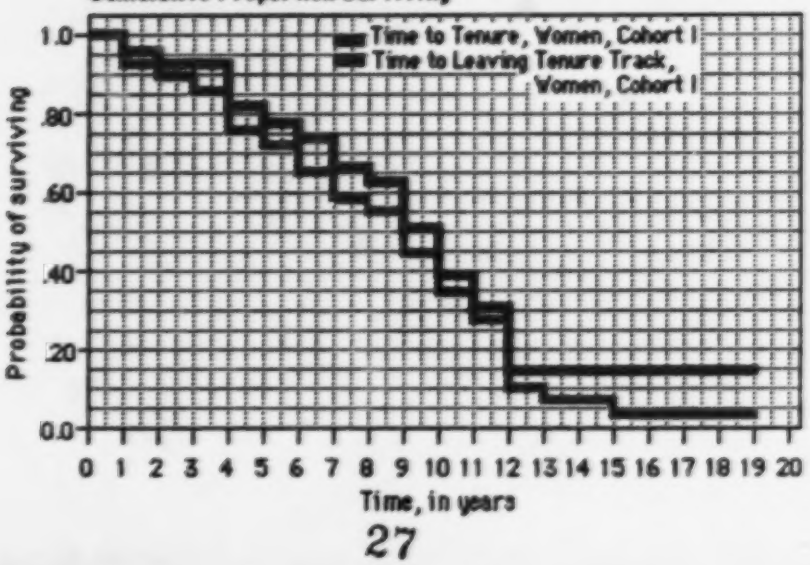
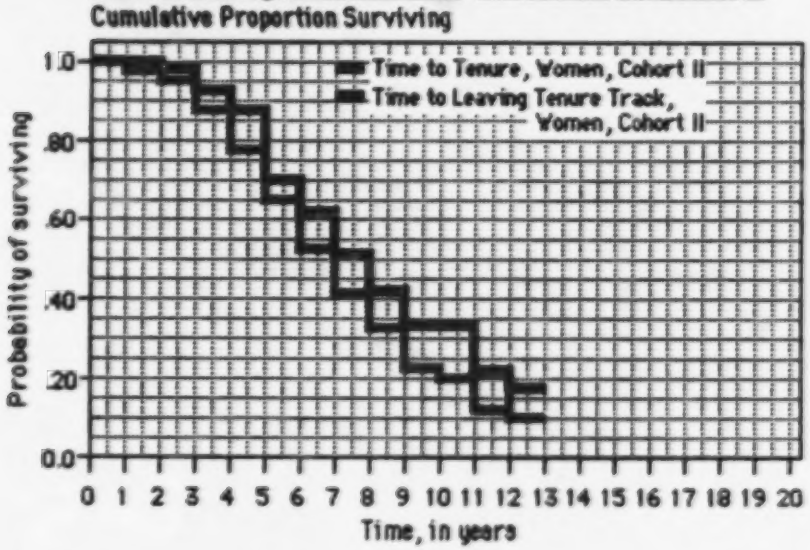

Cumulative Proportion Surviving
Time to Tenure, Women, Cohort I
Time to Leaving Tenure Track, Women, Cohort I
Probability of surviving
1.0
.80
.60
.40
.20
0.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Time, in years

Figure 12: Survival curves for time to tenure and time to leaving tenure-track, for women in Cohort II


Cumulative Proportion Surviving
Time to Tenure, Women, Cohort II
Time to Leaving Tenure Track, Women, Cohort II
Probability of surviving
1.0
.80
.60
.40
.20
0.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Time, in years

Unlike the curves for men in Cohort I, both of these pairs of curves show fairly regular gaps for most of their lengths, indicating that women in both cohorts left tenure-track positions without receiving tenure at various times throughout their careers, rather than in a pattern.

Using the Cox Proportional Hazards Regression Model to Model Time to Tenure

Lifetable analyses can be used to provide preliminary information about which variables have predictive importance, but multivariate techniques are necessary to examine simultaneous effects of the variables on survival, or time to tenure. A general nonparametric model, the Cox proportional hazards regression model can be used to analyze survival data when the survival times are influenced by other measured variables. It assumes that hazard rates may be modeled as log-linear functions of the covariates, and is used to identify a subset of independent variables which are significantly related to the hazard rate and consequently to the time to tenure.

The hazard function represents the probability of tenure during a short time interval, in this case one year, assuming the individual has survived to the beginning of the interval. The Cox proportional hazards regression models the expected proportion of individuals who will be

granted tenure in any given year after receiving the Ph.D.

A subprogram of BMDP, BMDP2L - Regression with Incomplete Survival Data,[7] was used to estimate the dependence of the survival probability for any given time on other variables ("covariates"), such as gender or cohort. The functional form of the dependence is estimated using the Cox proportional hazards model. The model may be expressed as follows:

$$\log_e\left(h_i(t)/h_o(t)\right) = \beta_1 x_{1i} + \beta_2 x_{2i} + \ldots + \beta_k x_{ki}$$

where $x_1, \ldots, x_k$ are k independent variables, t_i is survival time, $h_i(t)$ = the hazard function of the ith respondent, and $h_o(t)$ = the hazard function of the underlying survival function when all the independent variables, x_i are zero, and β_i = regression coefficients.

Regressions were run with a variety of possible covariates, including gender and cohort. Some variables which logically seem to be related to time to tenure, particularly those dealing with productivity, such as number of publications by a certain point in one's career, could not be used because of problems with the way the data was collected. The covariates used in modelling the hazard function of time to tenure for the whole group of respondents were gender, cohort, length of time spent in earning the doctorate, and two dichotomous variables indicating whether a respondent had children or was childless at the time of receiving the Ph.D. and whether he or she was currently married at the time of receiving the Ph.D.

Gender was coded as a dichotomous variable called MALE, for which 0=female and 1=male. Cohort was similarly coded as COHORT1, for which 0=Cohort II and 1=Cohort I. The length of time spent in earning the Ph.D., PHDTIME, is a continuous variable. It was used as a possible measure of productivity; if an individual earned a doctorate more quickly, it seemed likely he or she might also be awarded tenure more quickly.

MARPHD is a dichotomous variable indicating whether the respondent was married or single at the time of receiving the Ph.D., for which 0=single and 1=married. Since marriage

provides supports for but may also constrain one's career and since marriages often affects men and women differently, it seemed possible that marital status would influence time to tenure, and we might expect to find gender differences for this variable. PHDKIDS is also a dichotomous variable, indicating whether or not the respondent had children at the time the Ph.D. was awarded, for which 0=no children and 1=one or more children. Since children take up a great deal of their parents' time, we would expect that having children might extend time to tenure; again, gender differences might be expected with longer times to tenure for women, since women's traditional family roles call for them to spend more time with their children and because the women in the sample are more likely than the men to be involved in dual career marriages.

The modelling program was run, first with the entire sample (n=257),[8] and then separately for men and women. The following tables give the covariates and datasets used for the various models.

Dataset used: All respondents who began academic careers, unless time to tenure was ≤ 0 or other related information was missing
N = 257

Variables used:	Name	Mean	Std. Dev.	Coefficient	Approx. χ^2	P-value
	MALE	0.53	0.50	0.50	10.88	0.00
	COHORT1	0.31	0.46		0.00	0.95
	PHDTIME	5.65	1.87	0.09	3.99	0.05
	PHDKIDS	0.29	0.46		2.06	0.15
	MARPHD	0.68	0.47	-0.31	3.50	0.06

In this model, two covariates, gender and time spent earning the doctorate, were significant at the .05 level, while a third covariate, whether or not the respondent was married at the time of receiving the doctorate, was significant at .06. This model suggests that being male, having spent longer earning the doctorate, and being single at the time of receiving the Ph.D. all lead to fewer years between receiving the Ph.D. and being awarded tenure. The direction of the significant covariate, PHDTIME, is surprising. Perhaps those who spend more time in doctoral

work often have significant publications prior to receiving the doctorate which give them a headstart in the tenure track. Or, it may be that those who receive the doctorate a longer time after beginning doctoral work have often started in tenure track positions before actually receiving the degree; in this case, the year of the Ph.D. is problematic as a "start" date.

Next, consider these same covariates in modelling the hazard function of time to tenure seperately for each gender.

Dataset used: All men who began academic careers, unless time to tenure was ≤ 0 or information was missing
N = 135

Variables used:	Name	Mean	Std. Dev.	Coefficient	Approx. χ^2	P-value
	COHORT1	0.36	0.48		0.13	0.71
	PHDTIME	5.62	1.98	0.12	4.00	0.05
	PHDKIDS	0.36	0.48		0.94	0.33
	MARPHD	0.71	0.45		0.01	0.94

In the model for men, only the covariate PHDTIME was significant in modelling the hazard function of time to tenure, again in the direction that the longer a respondent spent in doctoral work, the fewer years between receiving the Ph.D. and being awarded tenure. Since marital status at the time of receiving the Ph.D. is no longer significant in the model for men, we would suspect that in the model for women, it would be influential.

Dataset used: All women who began academic careers, unless time to tenure was ≤0 or other related information was missing
N = 122

Variables used:	Name	Mean	Std. Dev.	Coefficient	Approx. χ^2	P-value
	COHORT1	0.26	0.44		2.35	0.13
	PHDTIME	5.68	1.74		0.41	0.52
	PHDKIDS	0.22	0.42		1.05	0.31
	MARPHD	0.65	0.48	-0.67	7.79	0.01

As expected, being single at the time of receiving the Ph.D. is related to shorter times to tenure for women. The number of years spent earning the doctorate is not a significant covariate in this analysis; PHDTIME is apparently related to time to tenure for men. There is no apparent

explanation for this gender difference. We might wonder to what extent being single or being married at the time of receiving the Ph.D. is a proxy for other factors, such as having children in the years immediately following the Ph.D.

Variables reflecting family and marital status some time after the doctorate may also be significant in predicting a model for time to tenure, but in order to use them in the regression model, it is necessary to omit cases of those who were awarded tenure before that time or who left the tenure track before that time; otherwise, we might be using events which took place after the award of tenure to predict time to tenure. Several other covariates indicating family and marital status five years after receiving the Ph.D. were used in the next three regressions.

In addition to MALE, COHORT1, and PHDTIME, six new variables were coded. A variable indicating whether or not the respondent had worked part-time or been unemployed during the five years following receipt of the Ph.D., PTEMP5, was included because it seemed that these employment patterns were likely to slow the tenure clock and be related to longer times to tenure. For PTEMP5, 0=no part-time employment or unemployment. Another variable, MAR5, indicated whether the respondent was single or married at five years after receiving the Ph.D.; this variable was included for the same reasons that MARPHD was included in the previous analyses, with the difference being that marital status at one time may be more influential than marital status at another time. For MAR5, 0=single and 1=married.

Another variable, DIV5, indicates whether or not the respondent had been divorced within the five years following receipt of the Ph.D. For this variable, 0=no divorce and 1=divorce. Divorce is likely to be a disruptive and traumatic event for an individual (Cherlin, 1981), and if divorce was experienced during the period of time when an individual was working toward tenure, we might expect time to tenure would be delayed.

Finally, three continuous variables related to the presence of children were used. One,

KIDS50, indicates the number of children in the respondent's family who were less than two years old at five years after receipt of the Ph.D. A second, KIDS52, indicates the number of children between two and five years of age at five years after receipt of the Ph.D. The third, KIDS55, indicates the number of children older than five in the household at five years after receipt of the doctorate. Children require a good deal of their parents' time, particularly in the first two years of life; between two and five years of age, they are still at the pre-school stage, but the family has had some time to adjust to new demands and new schedules. Thus, if the presence of children is less likely to interfere with parents' career development as the children grow older, we might expect to see more influence of the younger children in modelling time to tenure.

Let us consider three analyses for these covariates. One models the hazard function of time to tenure for the group of respondents, omitting those who received tenure or left the tenure track within five years of receiving the doctorate. The second and third model the hazard function of time to tenure seperately for men and for women.

Dataset used: All respondents who began academic careers, unless time to tenure was ≤ 5 or other information was missing
N = 180

Variables used:	Name	Mean	Std. Dev.	Coefficient	Approx. χ^2	P-value
	MALE	0.47	0.50		1.31	0.25
	COHORT1	0.28	0.45		0.08	0.77
	PHDTIME	5.54	1.69		0.01	0.90
	PTEMP5	0.22	0.41	-1.28	16.77	0.00
	MAR5	0.72	0.45		2.05	0.15
	DIV5	0.11	0.31		0.30	0.58
	KIDS50	0.18	0.39		1.60	0.21
	KIDS52	0.46	0.69		0.42	0.52
	KIDS55	0.48	1.02		0.51	0.47

The only significant variable in the regression model is PTEMP5, indicating whether or not an individual has worked part-time or been unemployed in the five years after receiving the doctorate. Not surprisingly, those who have worked part-time or been unemployed are likely to

take longer to receive tenure. It is interesting that gender proves not to be significant in this model, indicating that the previous gender differences noted in time to tenure may have been based in large part on the greater tendency among women to work part-time or be unemployed. In fact, of the 32 respondents in this analysis who had been employed part-time or unemployed at some point during the five years following the Ph.D., 31 were women and only one was a man.

Let us consider the same covariates in regression models for men and for women.

Dataset used: All men who began academic careers, unless time to tenure ≤ 5 or other information was missing
N = 84

Variables used:	Name	Mean	Std. Dev.	Coefficient	Approx. χ^2	P-value
	COHORT1	0.30	0.46		0.50	0.48
	PHDTIME	5.40	1.58		0.02	0.87
	PTEMP5	0.05	0.21		0.06	0.80
	MAR5	0.73	0.45		0.68	0.41
	DIV5	0.11	0.31		0.13	0.72
	KIDS50	0.18	0.39		1.20	0.27
	KIDS52	0.43	0.63		0.58	0.45
	KIDS55	0.63	1.25		0.76	0.38

In the model above, no terms are significant in influencing time to tenure.

Dataset used: All women who began academic careers, unless time to tenure ≤ 5 or other information was missing
N = 98

Variables used:	Name	Mean	Std. Dev.	Coefficient	Approx. χ^2	P-value
	COHORT1	0.26	0.44		1.47	0.22
	PHDTIME	5.66	1.78		0.09	0.77
	PTEMP5	0.36	0.48	-1.31	13.33	0.00
	MAR5	0.71	0.46		1.94	0.16
	DIV5	0.10	0.31		0.23	0.63
	KIDS50	0.19	0.39		0.63	0.43
	KIDS52	0.49	0.74		0.24	0.63
	KIDS55	0.34	0.74		0.27	0.61

As expected, the model for women shows a strong delaying influence of PTEMP5 on time to tenure. We cannot know from the data to what extent part-time work or periods of unemployment were choices for the individuals involved, and interviews could better provide more information. Yet, of the 32 respondents in this analysis who had worked part-time or

been unemployed at all during the five year period following receipt of the Ph.D., 21 had pre-school children during that time. Thus, it seems probable that many of these individuals had used part-time work to help accommodate family and career.

Of the 21 respondents who had worked part-time or had been unemployed at some time during the five years after receipt of the Ph.D. and who had pre-school children at five years after the Ph.D., 9 left the academic profession altogether before receiving tenure, 6 left the tenure-track but stayed in academic teaching or research positions, 3 had been awarded tenure by 1983, and another 3 were in tenure-track positions. Clearly, it is possible to work part-time without foregoing a tenured position, and some have used this "hidden passage" with success. It is not possible to speculate about those who left the academic profession or the tenure track, because the data do not reveal if these individuals left because of difficulties related to combining academic careers and family or for other reasons.

Let us now turn to a somewhat different analysis. When observed time to tenure by field was examined, there appeared to be gender differences in time to tenure primarily in three fields - biology, economics, and English; there was also a large gender difference in time to tenure for sociology, but only 2 cases were involved, one male and one female. We can use Cox regressions to explore this difference.

A pair of Cox regressions divided the respondents into two groups, those whose doctorates were in biology, economics, or English, and those who received Ph.D. degrees in anthropology, history, philosophy, political science, psychology, or sociology. The following tables indicate the covariates influencing time to tenure for each of these two groups. Among the respondents receiving degrees in anthropology, history, political science, philosophy, psychology, or sociology, the covariates which previously were significant in modelling the hazard function of time to tenure, gender, years spent earning the doctorate, and whether married or single at the

time of receiving the doctorate, are no longer significant.

Dataset used: N = 129	All respondents in the fields of anthropology, history, political science, philosophy, psychology, or sociology, unless time to tenure ≤ 0 or other information was missing				
Variables used:	Name	Mean	Std. Dev.	Coefficient	Approx. χ^2	P-value
	MALE	0.54	0.50		0.26	0.61
	COHORT1	0.37	0.48		0.04	0.85
	PHDTIME	5.60	1.85		1.24	0.27
	PHDKIDS	0.33	0.47		0.30	0.58
	MARPHD	0.67	0.47		0.20	0.66

Yet, in considering the respondents in the fields of biology, economics, or English, we find the three covariates which were significant in modelling the hazard function of time to tenure for the whole sample are once again significant.

Dataset used: N = 131	All respondents in the fields of biology, economics, or English, unless time to tenure ≤ 0 or other information is missing				
Variables used:	Name	Mean	Std. Dev.	Coefficient	Approx. χ^2	P-value
	MALE	0.51	0.50	0.84	13.98	0.00
	COHORT1	0.26	0.44		0.40	0.53
	PHDTIME	5.70	1.88	0.12	4.25	0.04
	PHDKIDS	0.25	0.44		1.47	0.23
	MARPHD	0.69	0.46	-0.55	4.95	0.03

This finding suggests that disciplinary field is influential in determining time to tenure, although there are not enough cases within each field to test for differences. Though it is not surprising to find differences in time to tenure among disciplinary fields, it is not clear why gender differences are significant for biology, economics, and English as a group, since those three fields appear to have little in common which would make them stand out from the other fields. There is no immediately apparent explanation for the differences, even considering the small, select nature of the sample.

Cases of Respondents with Long Times to Tenure

To gain additional insight about factors relevant to time to tenure, I undertook a

case-by-case examination of respondents whose time to tenure was longer than most others'. The purpose was to see if some common patterns emerged which were not characterized by the definition of variables used in the survival analyses. The career and family patterns of the fourteen women and ten men who received tenure ten or more years after receiving their doctorates were considered. This group comprises roughly the ten percent of those at the far end of the observed time to tenure distribution.

Several common threads emerge from these cases. Let us first consider the group of women whose time to tenure was ten years or longer. Three respondents, two in biology and one in psychology, had spent a number of years in postdoctoral research positions before beginning as tenure-track assistant professors, which contributed to their longer than average time to tenure. Another three who had delayed times to tenure had spent several years working part-time; often they had very young children during this time. Another five had spent five to seven years at one university as untenured assistant professors before moving to another university, where some began again as assistant professors; this group may have been denied tenure, or, for some other reason moved just about the time a tenure decision would ordinarily have been made.

Thus, for women, it appears several factors may contribute to a lag in time to tenure, some possibly related to disciplinary career paths or other career choices, some related to family or other non-professional life choices, and still others a consequence of career performance evaluations. Clearly, the second may well be gender-related, since it is usually women who take on primary responsibility for care of children, and they may choose to work part-time as a result. It is interesting, though, that half of the women in this group had no children (40% of women respondents in the sample as a whole had no children). The other two noted trends, however, are not obviously gender-related. It would seem likely that men too

would be subject to certain disciplinary career paths or unfavorable tenure decisions.

Now consider the patterns for the ten men whose time to tenure was ten years or more. Of the ten, eight had spent five to seven years at one university as an untenured assistant professor before moving to another university; again, this pattern may possibly be related to unfavorable tenure decisions. One had two concurrent appointments and some concurrent projects which probably contributed to a delayed tenure decision. The last had moved several times, spending a couple years here and a couple there as assistant professor.

Thus, it appears that longer times to tenure for women were linked to a variety of career patterns, including working in non-tenure-track teaching or research positions prior to beginning tenure-track positions, and working part-time, thus delaying the tenure clock. Longer times to tenure for both men and women were linked to an investment of several years of time at one institution in a tenure-track position prior to moving to a second tenure-track position at another college or university; a logical explanation for such a move is that the individual was denied tenure. This sample is may be too small to reflect differences between men and women in the general population, but it is surprising to have found delays in tenure related to postdoctoral research for women and not for men. It is possible that postdoctoral research may serve as another "hidden passage" for women who are combining family and academic careers in allowing a less stressful but still accepted career option prior to beginning a tenure track position.

We now turn to consider those who have not yet received tenure.

Cases of Respondents Still Working toward Tenure

We have considered the cases of respondents whose time to tenure was longer than average. As noted earlier in the discussion of the need for survival data analysis, actual time to tenure is

longer than observed time to tenure because some individuals had not yet received tenure at the time the data was collected. This section considers the career and family patterns of those who are still working toward tenure to see what circumstances may have contributed to their being in tenure-track positions at such a late date compared with their colleagues.

Eleven respondents identified themselves as being in "tenure-track" positions in 1983. These individuals were all in Cohort II and in 1983 were between eleven and thirteen years past receipt of the doctorate. Four of the eleven were men, seven were women. Three had received their doctorates in biology, three in English, two in sociology, and one each in economics, philosophy, and psychology.

There was a wide variety of experiences among those who were still in the tenure-track a dozen or so years after receiving their doctorates. Five were apparently progressing in academic careers at a slower rate because they were working part-time, presumably by their own choice. Three had spent several years in lecturing positions before being appointed to positions as assistant professors. Two others had been denied tenure or left tenure-track positions at one place and started over again in a tenure-track position at another college or university, resetting the tenure clock each time. Three had taken on lengthy postdoctoral research positions before being appointed assistant professors; for one, the length of the tenure-track at his university seemed to be longer than average, even for those working full-time. Three others had moved from assistant professorships at one university to another and then to a third, with no particular reason for these moves apparent from the data collected.

In some cases, it seemed likely that family patterns of marital status or childbirth had influenced career decisions. In other cases, family patterns seemed a less likely influence. Although the number of cases is too small to draw any conclusions, it is interesting to note that only one of the eleven in tenure-track positions in 1983 had been divorced.

The individual experiences of those still working toward tenure were similar to those of the respondents who had unusually long times to tenure. Further research is necessary to explore how career decisions are made: why individuals choose or search for certain kinds of positions, why certain moves were made, what choices were available, and what information was known about the consequences of decisions.

Summary

This paper has considered how long it takes an individual to achieve tenure from several different perspectives: 1) observed time to tenure for respondents who received tenure, 2) estimated time to tenure including "censored" data from those still working toward tenure and those who left the tenure track along the way, using survival analysis, 3) testing the significance of variables related to time to tenure, using the Cox proportional hazards regression model, and 4) investigation of individual cases of respondents who had unusually long periods between receiving the Ph.D. and being awarded tenure and of those who were still working toward tenure.

More than 90% of the respondents originally began academic careers; by 1983, 78% of these men and 62% of these women had been awarded tenure. The mean time between the Ph.D. and tenure for all who had tenure by 1983 was 5.7 years. This figure, however, does not include data from those who left the tenure track or those still working toward tenure, and thus underestimates the expected time to tenure. Survival analysis is used to estimate time to tenure in a way which includes this "censored" data. Though some respondents had moved from non-tenure-track teaching or research positions to tenure-track positions, an examination of the individual cases of those still working in non-tenure-track positions in 1983 suggested that these individuals were not likely to move into tenure-track positions. Hence, they should be counted as having left the tenure track, rather than as still working toward tenure. Because of

technical difficulties in analyzing the data and an impression that such cases were rare exceptions, cases were omitted in which respondents had received tenure before or in the same year as the Ph.D. After omitting these cases, the mean and median of the distribution of observed time to tenure for the sample were both 6.0 years.

Lifetable analyses estimated median time to tenure for the whole sample at 6.3 years; other median times to tenure were 5.6 years for men and 7.6 years for women, compared with median observed times to tenure of 5.5 years for men and 7.0 years for women. The gender difference in estimated time to tenure diminished but did not disappear from Cohort I to Cohort II. Men received tenure at a rapid rate between 4 and 7 years after the Ph.D., while women were awarded tenure at a more gradual rate over a longer period of years.

Survival curves were also used to investigate the patterns of individuals leaving academic careers before being awarded tenure. Men were most likely to leave between years 5 and 7, suggesting that most departures were prompted by unfavorable tenure decisions. Women were not more likely to leave at any one period than another. It may be that women in greater proportions than men leave the tenure-track for reasons other than unfavorable tenure decisions. Comparison of these patterns between cohorts suggests that fewer individuals than previously are waiting for unfavorable tenure decisions before leaving tenure-track positions.

The Cox proportional hazards regression models the hazard function of time to tenure, using survival data. It is used to identify a subset of variables, or covariates, which are significantly related to the hazard rate and consequently to the time to tenure. Results from these analyses indicated that among all respondents, three variables were significantly related to time to tenure: gender, time spent earning the doctorate, and whether the individual was married or single at the time of receiving the doctorate. Men, those who spent longer earning the doctorate, and single people were likely to have shorter times to tenure. When these

covariates were tested for subsamples of men and women, I found that time spent earning the doctorate is significant for men but not for women, and being married or single at the time of the Ph.D. is significant for women but not for men. Cohort and whether or not there were children in the family at the time of the Ph.D. were not significantly related to time to tenure.

Still using the Cox proportional hazards model, covariates were considered which represented family, marital, and employment status at five years after the Ph.D. It was necessary to omit cases in which respondents had been awarded tenure or left the tenure track less than six years after the doctorate. In this analysis, the only covariate significantly related to time to tenure was whether or not a respondent had worked part-time or been unemployed at all during the five years after the Ph.D.; those who had worked part-time or been unemployed had longer times to tenure. Variables which were not found to be significant were: gender, cohort, time spent in earning the doctorate, marital status at five years post-Ph.D., number of children less than two years old at five years post-Ph.D., number of children 2-5 years old at five years post-Ph.D., and number of children older than five at five years post-Ph.D. When separate analyses were run for men and for women, no covariates were significant in the analysis for men, while whether or not a respondent had worked part-time or been unemployed at all during the five years after the Ph.D. was significant for women. Since most of those who had worked part-time or had been unemployed had pre-school children during that time, it seems probable that many had used part-time work to help accommodate family and career.

A last pair of Cox regression analyses revealed that gender, time spent earning the Ph.D., and marital status at the time of the Ph.D. are significant for a group of respondents whose disciplinary fields were biology, economics, or English; but no covariates were significant for the group comprising the rest of the sample -- those with degrees in anthropology, history, philosophy, political science, psychology, or sociology. There is no readily apparent explanation

for this finding.

Examination of specific cases indicated that longer times to tenure among women may be related to part-time work, work in non-tenure-track teaching or research positions prior to beginning tenure-track positions, and tenure denials at one university. Longer times to tenure among men seem primarily to be related to tenure denials.

The various findings offer support for the idea that women in the academic profession use "hidden passages" -- professionally acceptable variations in career patterns, such as part-time work or postdoctoral research positions -- to accommodate families and careers. Previously, such variations were not very accepted (Caplow and McGee, 1958), or at least do not appear to have been widely available options in most sectors of the academic labor market (Bernard, 1964). Evidence of individuals in this sample who have used these "hidden passages" and have also achieved tenure or are still in the tenure track suggests that they are now more professionally acceptable variations.

NOTES

[1] See Carol Blue Muller, Career and Family Patterns of Men and Women Doctoral Recipients, 1986.

[2] Here I use "professional" as Bernard (1964) has done, to distinguish regular tenured and tenure-track personnel from those with "fringe benefit status" who fit in at the margins of the academic profession, such as lecturers, visiting scholars, research associates, and adjunct professors. The labor markets for those with "fringe benefit status" are considerably more flexible, but it has been assumed that individuals can rarely move from these labor markets to the professional academic labor markets (Caplow and McGee, 1958).

[3] McGee's (1971) study of the labor market of eleven private Midwestern colleges is a notable exception. He marked the importance of wives' preferences and influences in determining the mobility of male professors. While a wife's "power" was generally restricted to a veto and had to be exercised quite subtly, it was nonetheless found to be a factor in the market decision-making process.

[4]This survey obtained information from 60,000 regular full-time faculty in 300 colleges and universities across the United States.

[5]A sample program for running the job is given in Appendix A-1.

[6]There was some ambiguity as to whether or not those who were in non-tenure-track teaching or research positions should be included as still working toward tenure or among those who had left, in which case we would refer to leaving the tenure-track rather than leaving the academic profession *per se*. The section following discusses these two different assumptions.

[7]A sample program for running the job is given in Appendix A-2.

[8]The entire sample was 257 respondents for these analyses, because the following cases of the original 293 respondents were omitted: 20 who never began academic careers, 9 whose time to tenure was less than or equal to zero, one who was employed at a university which did not grant tenure, and 6 for whom data necessary for the analysis were missing.

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Appendix A: Sample Program set-ups for BMDP survival analyses

1. BMDP1L - Life Tables and Survival Functions:

```
/PROBLEM TITLE IS 'LIFETABLE ANALYSIS WITH EXISTING CODING'.
/INPUT VARIABLES ARE 5.
      CASE=265.
      FORMAT IS '(F3.0,5X,F1.0,1X,F1.0,1X,F2.0,3X,F1.0)'.
      UNIT=8.
/VARIABLE NAMES ARE ID,COHORT,SEX,EXITTT,SURVIVAL.
      ADD=0.
/GROUP CODES(3) ARE 1,2.
      NAMES(3) ARE MALE,FEMALE.
      CODES(2) ARE 1,2.
      NAMES(3) ARE COHORT1,COHORT2.
      CODES(5) ARE 0,1,2.
      NAMES(5) ARE TENURED,STILLWRK,LEFTACAD.
/FORM TIME IS EXITTT.
      STATUS IS SURVIVAL.
      RESPONSE=0.
      LOSS=1,2.
/ESTIMATE METHOD IS LIFE.
      WIDTH=1.0.
      GROUP IS SEX.
      PLOT=SURV,DUM,HAZ,DEN.
      STATISTICS=MANTEL,BRESLOW.
/END.
```

2. BMDP2L - Regression with Incomplete Survival Data:

```
/PROBLEM TITLE IS 'COX REGRESSION ON TENURETIME DATA'.
/INPUT VARIABLES ARE 7.
      CASE=263.
      FORMAT IS '(12X,F2.0,3X,F1.0,1X,6F3.0,F1.0,3F2.0)'.
      UNIT=8.
/VARIABLE NAMES ARE EXITTT,SURVIVAL,MALE,COHORT1,
      PHDTIME,PHDKIDS,MARPHD.
      ADD=0.
/GROUP CODES(2) ARE 0,1,2.
      NAMES(2) ARE TENURED,STILLWRK,WTHDRAWN.
/FORM TIME IS EXITTT.
      STATUS IS SURVIVAL.
      RESPONSE=0.
      LOSS=1,2.
/REGRESS COVARIATES ARE MALE,COHORT1,PHDTIME,PHDKIDS,
      MARPHD.
      STEPWISE=MPLR.
/END.
```